

# Articles

## Moose Soup Shigellosis in Alaska

BRADFORD D. GESSNER, MD, *Atlanta, Georgia, and*

MICHAEL BELLER, MD, MPH, *Anchorage, Alaska*

Following a community gathering held in early September 1991, an outbreak of gastroenteritis occurred in Galena, Alaska. We conducted an epidemiologic investigation to determine the cause of the outbreak. A case of gastroenteritis was defined as diarrhea or at least 2 other symptoms of gastrointestinal illness occurring in a Galena resident within a week of the gathering. Control subjects included asymptomatic residents who either resided with an affected person or were contacted by us during a telephone survey. Of 25 case-patients, 23 had attended the gathering compared with 33 of 58 controls. Among persons who attended the gathering and from whom we obtained a food consumption history, 17 of 19 case-patients and 11 of 22 controls ate moose soup. No other foods served at the gathering were associated with illness. Ten case-patients had culture-confirmed *Shigella sonnei*. Many pots of moose soup were served each day, and persons attended the gathering and ate moose soup on more than 1 day. Moose soup was prepared in private homes, allowed to cool, and usually served the same day. We identified 5 women who had prepared soup for the gathering and in whose homes at least 1 person had a gastrointestinal illness occur at the time of or shortly before soup preparation. This investigation suggests that eating contaminated moose soup at a community gathering led to an outbreak of shigellosis and highlights the risk of eating improperly prepared or stored foods at public gatherings.

(Gessner BD, Beller M: Moose soup shigellosis in Alaska. *West J Med* 1994; 160:430-433)

On September 11, 1991, a nurse practitioner at the clinic in Galena, Alaska, notified the Alaska Division of Public Health of an outbreak of illness characterized by fever, chills, muscle aches, and diarrhea among persons who had recently attended a community gathering called a potlatch. The next day, a person who had attended the potlatch and who was subsequently admitted to a hospital was diagnosed with laboratory-confirmed shigellosis. We initiated an investigation to characterize the outbreak and determine possible causes.

Galena is a predominantly Alaska Native village located in the central part of the state; the provisional population estimate as of July 1, 1991, was 829. A potlatch is a traditional Alaska Native community gathering held over one or more evenings. Many persons may bring similar foods to a potlatch, and each person attending may bring more than one type of food. Galena residents estimated that 300 to 500 persons of all ages attended each day of a potlatch held in the high school gymnasium on September 5 to 7 and 9. The facility was equipped with running water and flush toilets.

### Patients and Methods

We defined a case of gastroenteritis as an illness in a person from Galena, with onset from September 6 to 13, consisting of diarrhea ( $\geq 3$  watery stools in a 24-hour pe-

riod) or at least two of the following symptoms: fever or chills, nausea or vomiting, abdominal pain, bloody stools, or mucus in the stools. During the initial case finding, we obtained a list of persons with acute gastrointestinal symptoms who had visited the Galena clinic—the only health facility in the village—from September 6 to 13. We went to the clinic on September 13 and 14, contacted persons on the list, and administered a standardized questionnaire to them and their household members. The questionnaire solicited information on demographic data, illness characteristics, dates of potlatch attendance, specific foods eaten at the potlatch, and food brought to the potlatch.

We expanded our case finding from September 13 to 20 by calling all 116 residential numbers listed in the Galena telephone directory a maximum of three times and administering the questionnaire to residents of each of the 19 households where at least one adult was located. Most unsuccessful attempts resulted from disconnected telephone numbers; no persons contacted refused to participate. Because of increasing difficulty with recall, after September 15 we did not ask residents which foods they had eaten at the potlatch.

Because we determined that potlatch attendance was a risk factor for illness, we further evaluated the risk among persons who had attended the potlatch. For this

From the Epidemic Intelligence Service, Division of Field Epidemiology, Epidemiology Program Office, US Centers for Disease Control and Prevention, Atlanta, Georgia (Dr Gessner), and Alaska Division of Public Health, Section of Epidemiology, Anchorage (Dr Beller).

Reprint requests to Michael Beller, MD, MPH, Section of Epidemiology, PO Box 240249, Anchorage, AK 99524-0249.

## ABBREVIATIONS USED IN TEXT

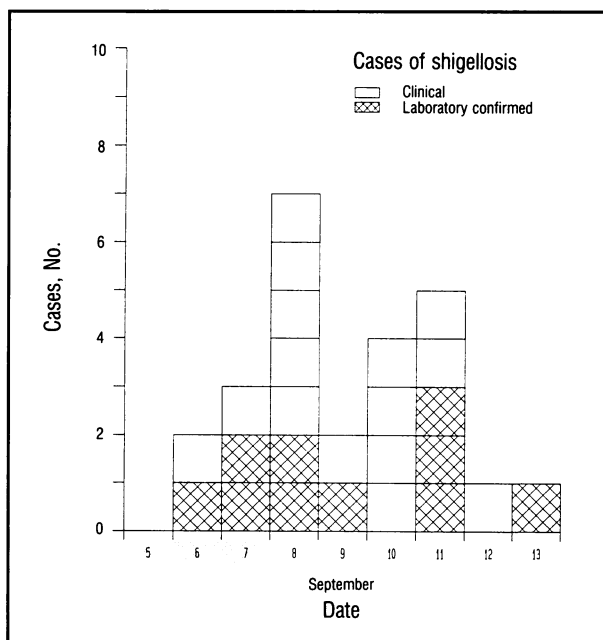
CI = confidence interval  
OR = odds ratio

analysis, case-patients were restricted to persons with illness occurring within 12 to 96 hours—the usual incubation period for shigellosis—after attendance at the potlatch. For control subjects, we selected non-ill interviewees who had attended at least one day of the potlatch.

Because acquired immunity might have prevented illness even if a substantial exposure occurred during the potlatch, persons who had illness consistent with the case definition but with onset between August 7 and September 5 (the first day of the potlatch) were not included as either cases or controls. Because many persons had difficulty recalling the exact foods they consumed at the potlatch, we analyzed food consumption using the following categories: salad (leaf, fruit, pasta, potato), moose soup (a homemade soup containing moose meat), local meat (moose, duck, bear), store-bought meat (turkey, ham), fish, Indian ice cream (lard from various animals mixed with sugar and wild berries), frybread, and dessert.

All ill residents whom we interviewed on September 13 or 14 were requested to submit a stool specimen. Fresh stool was collected by the patient or a parent or guardian and placed in Carey-Blair transport media. Cultures were performed by the State Public Health Laboratory, Anchorage.

Odds ratios (OR) and Cornfield confidence intervals (CI) were determined using Epi Info computer software.<sup>1</sup> When an expected cell size was 5 or less, we used exact confidence intervals.



**Figure 1.**—Cases of shigellosis are depicted by day of onset for the outbreak in Galena, Alaska, from September 6 to 13, 1991. Shaded days indicate dates of the potlatch.

**TABLE 1.**—Case-Patients and Controls Who Consumed Particular Foods at a Potlatch, Galena, Alaska, 1991

Food	Case-Patients (n = 19), No.	Controls (n = 23), No.	Odds Ratio (95% CI)
Moose soup*.....	17	11	8.5 (1.4, 88.6)
Dessert.....	15	14	2.4 (0.5, 13.0)
Salad.....	14	14	1.8 (0.4, 8.6)
Meat, local.....	8	7	1.7 (0.4, 7.3)
Meat, store bought*...	10	10	1.3 (0.3, 5.6)
Fish.....	5	5	1.3 (0.2, 6.8)
Frybread.....	4	4	1.3 (0.2, 8.0)
Indian ice cream.....	8	11	0.8 (0.2, 3.3)

CI = confidence interval

\*Moose soup and meat (store bought) consumption history could not be recalled by 1 control each.

## Results

A total of 100 persons were interviewed; 51 and 49 through the clinic and telephone survey, respectively. Of these, 17 had symptoms consistent with the case definition, but their illness had occurred from August 7 to September 5, so they were not included in further analysis. The illness onset dates for these 17 people were evenly distributed over the 29 days before the potlatch. Of the remaining 83 persons, 42 (51%) were female, and ages ranged from 6 months to 76 years (median, 26 years). Nearly a third (25) met the case definition; 12 were still sick when interviewed. Symptoms included diarrhea (21 [84%]), fever (20 [80%]), abdominal pain (20), chills (18 [72%]), nausea (17 [68%]), vomiting (11 [44%]), mucus in the stools (5 [20%]), and bloody stools (5). Illness incidence was bimodal with peaks on September 8 and 11 (Figure 1). Among those who had recovered and recalled the date their illness began, the median duration of illness was three days (range, 1 to 7 days). Of the 25 case-patients, 23 had attended the potlatch, compared with 33 of the 58 people who did not have illness meeting the case-definition (OR = 8.7; 95% CI = 1.8, 81.4).

Among the 56 persons who attended at least one day of the potlatch, attendance varied from 17 (30%) to 46 (82%) per day; 36 (64%) attended on two or more days. We selected the 56 persons who attended the potlatch for further study. Among persons asked about food consumption who were able to recall, 17 of 19 case-patients and 11 of 22 controls recalled eating moose soup (OR = 8.5; 95% CI = 1.4, 88.6). No other foods were implicated (Table 1). No persons ate only moose soup. Compared with controls, case-patients were nearly 4 times more likely to report eating moose soup on one day and 30 times more likely to report eating moose soup on two or more days (Table 2). Because most persons who attended the potlatch did so on at least two days and many had difficulty recalling the specific days they attended, we could not evaluate the risk of attending the potlatch on any particular day.

## Environmental Investigation

We estimated that 10 to 15 pots of moose soup were

TABLE 2.—Case-Patients and Controls Who Consumed Moose Soup on 0, 1, and  $\geq 2$  Days of a Potlatch, Galena, Alaska, 1991

Days Moose Soup Consumed, No.	Case-Patients (n = 19), No.	Controls (n = 22), No.	Odds Ratio (95% CI)
0 .....	2	11	Referent
1 .....	6	9	3.7 (0.5, 43.8)
$\geq 2$ .....	11	2	30.3 (2.7, 417.7)

CI = confidence interval

served each day of the potlatch. One or two pots were 15 liters; the rest were smaller. Soup was prepared by boiling moose meat for several hours in water and spices, sometimes with rice and vegetables added depending on the preference of the preparer. After cooking, soups were cooled for an estimated one to more than five hours and then served without reheating. Of four moose soup preparers interviewed, one said that some people brought soup to the potlatch that had been prepared for an earlier day of the potlatch.

The number of people who prepared moose soup each day was unknown. Five women were identified who had prepared moose soup for the potlatch and in whose homes at least one person had symptoms occur that met the case definition either at the time of or shortly before they prepared soup. Of these women, two were ill themselves, and one of these was still ill when she made moose soup. Two of the five preparers identified could not recall the specific days they brought moose soup to the potlatch; among the other three women, two each day brought soup on September 5, 6, and 7.

#### Laboratory Analysis

Of the 23 case-patients interviewed at the clinic on September 13 or 14, 13 submitted stool specimens for culture; 10 of these were positive for *Shigella sonnei*. All persons with a positive culture had their illness begin 12 to 96 hours after attending the potlatch.

#### Discussion

We describe an outbreak of shigellosis due to *S sonnei* that occurred in rural Alaska. In general, *S sonnei* is the most common *Shigella* serotype isolated in the United States and other developed countries.<sup>2</sup> In contrast, *Shigella dysenteriae* type 1, which produces Shiga toxin and a more virulent illness, occurs more frequently in developing countries.<sup>3</sup> Our investigation suggests that disease transmission was probably occurring for at least a month before the outbreak and that the ongoing transmission of *Shigella* species may have provided an opportunity for the outbreak to occur. The case-control study revealed an association between eating moose soup and illness. Illness in the homes of one or more food preparers concurrent with or shortly before moose soup preparation might have resulted in the contamination of soup with *S sonnei*. Alternatively, soup could have been inoculated at the potlatch by one of the people serving it. Because soup was allowed to cool before it was served and

because leftover soup may have been served, bacterial growth may have occurred. The preparation of moose soup in one or two 15-liter pots suggests a possible mechanism for the spread of *S sonnei* to a large group of people who ate soup.

Because most people attended the potlatch on at least two days but many had difficulty recalling the specific days, we could not evaluate the risk associated with attendance or the consumption of moose soup on a particular day. It is possible that contaminated soup was served on more than one day, either from the same preparer or from two different preparers. The bimodal epidemic curve (Figure 1), together with the absence of a potlatch on September 8, suggests that contaminated soup may have been served first during September 5 to 7 and then again on September 9. The finding that the risk of illness was greater among persons who ate moose soup on multiple days is also consistent with the hypothesis that contaminated soup was served on more than one day. The latter finding could also be explained by an increased likelihood among persons who attended the potlatch on more than one day of being present on the single day that contaminated soup was served.

There are several limitations to the interpretation of these results. Five of the eight foods were eaten by a minority of persons who attended the potlatch. This may be because eating food at a potlatch is more important as a symbol of community participation than as a meal, and eating even small amounts of food may suffice for this purpose. Recall bias of either food consumption or date(s) of attendance could have resulted in the misclassification and underestimation or overestimation of effect. Collapsing foods into larger groups may have caused us to miss an association between a particular food and illness. Our data were also somewhat limited because we did not obtain food histories from people interviewed after September 15.

Shigellosis most commonly spreads as a result of person-to-person contact, although foodborne transmission has also been reported.<sup>3,7</sup> At a temperature of 25°C to 37°C, *Shigella* species has been shown to multiply exponentially in a variety of foods, including soup.<sup>8</sup> Mass gatherings represent an efficient mechanism for the widespread transmission of enteric pathogens; a major event in 1987 resulted in the nationwide dissemination of a multiple-antibiotic-resistant strain of *S sonnei* in the United States.<sup>9</sup> Because soup is usually served hot, it is an unusual vehicle.<sup>4,7</sup> Our investigation suggests that during multiday events, when leftovers might be served and when several hours elapse between preparation and consumption, soup should be considered a possible vehicle.

From 1968 to 1992, the Alaska Division of Public Health investigated four other shigellosis outbreaks with more than 10 cases (540 total cases); all but one outbreak occurred in rural areas (unpublished records). Rural Alaskans, such as those described in this report, may be at an increased risk of shigellosis because of geographic and cultural factors: the availability of running water may be limited; houses may be crowded with people indoors for

long periods, especially during the winter; and access to medical facilities for early diagnosis and treatment may be limited. In addition, community gatherings are common in rural Alaska; as we have reported in this investigation, endemic shigellosis can provide a setting in which common-source outbreaks occur.

To prevent secondary illness from this outbreak, we attempted to decrease *Shigella* species transmission by instituting appropriate control measures.<sup>2,10,11</sup> First, we conducted active surveillance for shigellosis by routinely contacting village health providers. We recommended that all persons with acute gastroenteritis have a stool culture and be treated with the combination of trimethoprim and sulfamethoxazole.<sup>12</sup> Second, we recommended that antimicrobial sensitivities be obtained for all isolates to monitor the possible development of resistant strains.<sup>13</sup> Finally, we recommended that an educational campaign emphasizing good personal hygiene be initiated at school assemblies and by the local news media.

To prevent future outbreaks, the importance of personal hygiene and proper methods of food preparation should be taught at schools and community events. Theoretically, in small towns experiencing endemic shigellosis, outbreaks may be prevented by cancelling community gatherings. Because enteric disease is ubiquitous and community gatherings have important social value, we recommend following basic hygienic measures rather than cancelling these events. In Alaska, potlatches could provide a good opportunity for education through

posters, flyers, and information booths. Specifically, privately prepared foods served at community gatherings should be maintained at appropriate temperatures,<sup>2,12</sup> by keeping them either properly refrigerated or heated until consumption.

#### REFERENCES

1. Dean AG, Dean JA, Burton AH, Dicker RC: Epi Info, Version 5: A Word Processing, Data-Base, and Statistics Program for Epidemiology on Microcomputers. Stone Mountain, Ga, USD, Inc, 1990
2. Benenson AS (Ed): Control of Communicable Diseases in Man. Washington, DC, American Public Health Association, 1990, pp 170-173
3. Keusch GT, Bennish ML: Shigellosis, chap 29, *In* Evans AS, Brachman PS (Eds): Bacterial Infections of Humans. New York, NY, Plenum Medical, 1991, pp 593-620
4. Donadia J, Gangarosa E: Foodborne shigellosis. *J Infect Dis* 1969; 119:666-668
5. Lew JF, Swerdlow DL, Dance ME, Griffin PM, et al: An outbreak of shigellosis aboard a cruise ship caused by a multiple-antibiotic-resistant strain of *Shigella flexneri*. *Am J Epidemiol* 1991; 134:413-420
6. Lee LA, Ostroff SM, McGee HB, et al: An outbreak of shigellosis at an outdoor music festival. *Am J Epidemiol* 1991; 133:608-615
7. Black RE, Graun GF, Blake PA: Epidemiology of common-source outbreaks of shigellosis in the United States 1961-1975. *Am J Epidemiol* 1978; 108:47-52
8. Islam MS, Hasan MK, Khan SI: Growth and survival of *Shigella flexneri* in common Bangladeshi foods under various conditions of time and temperature. *Appl Environ Microbiol* 1993; 59:652-654
9. Wharton M, Spiegel RA, Horan JM, et al: A large outbreak of antibiotic-resistant shigellosis at a mass gathering. *J Infect Dis* 1990; 162:1324-1328
10. Centers for Disease Control: Community outbreaks of shigellosis—United States. *MMWR* 1990; 39:509-519
11. Kahn MU: Interruption of shigellosis by handwashing. *Trans R Soc Trop Med Hyg* 1982; 76:164-168
12. Weissman JB, Gangarosa EJ, Dupont HL, Nelson JD, Haltalin KC: Shigellosis: To treat or not to treat. *JAMA* 1974; 229:1215-1216
13. Weissman JB, Gangarosa EJ, Dupont HL: Changing needs in the antimicrobial therapy of shigellosis. *J Infect Dis* 1973; 127:611-613